Aug. 3, 1965 S. W. MARTIN 3,198,517

DOCUMENT HANDLING MEANS

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Fig. 1

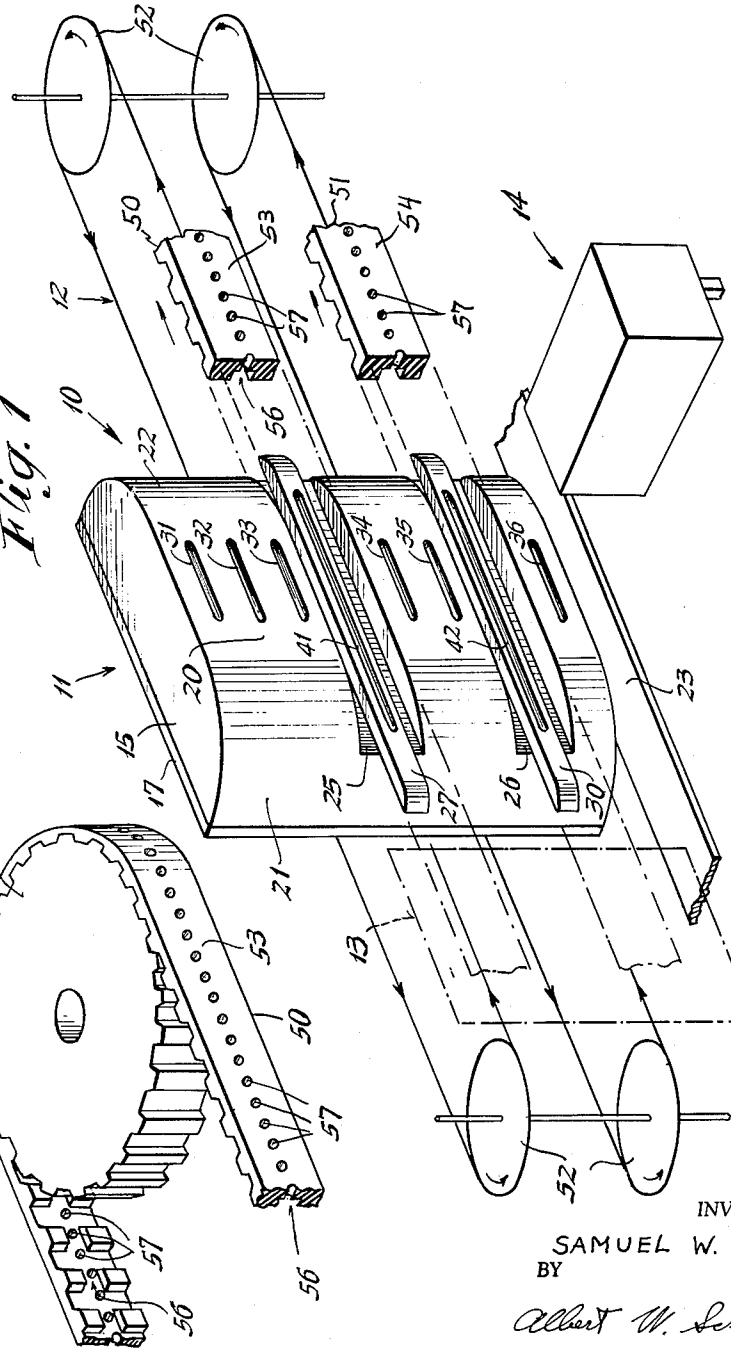


Fig. 4

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Fig. 3

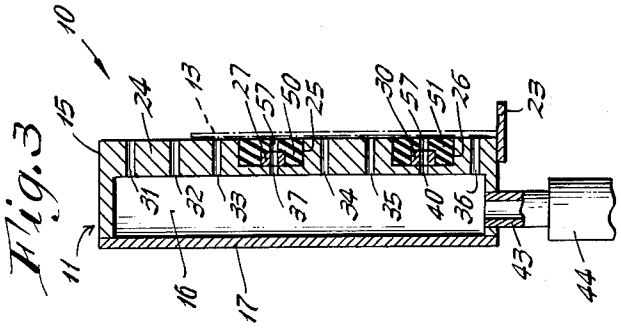
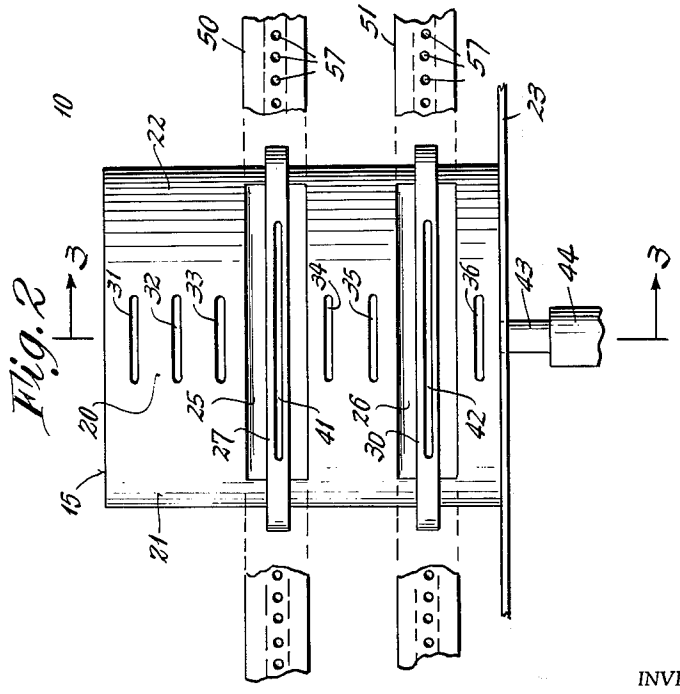


Fig. 2



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United States Patent Office 3,198,517 Patented Aug. 3, 1965

3,198,517

DOCUMENT HANDLING MEANS

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Filed Nov. 14, 1962, Ser. No. 237,580
12 Claims. (Cl. 271—74)

This invention relates to an improved document transport, guide and supporting means. More particularly the invention relates to a novel means for moving a document into and along a predetermined plane during travel through a work station.

In many present day data processing machines records or documents are transported at very high speeds through various reading, punching or like work stations. For example in some magnetic ink character recognition systems documents may be successively fed past a reading head at a rate of 1200 to 1600 pieces per minute or higher. When a moving document is being sensed or read by a magnetic reading head at such speeds it is imperative that the document be physically smoothed out and moved through a fixed predetermined plane relative to the sensing head during the reading operation. If these conditions are not met then the reading operations may become unreliable or inaccurate due to wrinkles or other physical variations in the essential portions of each document face as the latter move past the character sensing means. Maintaining both a uniform orientation and a uniform high speed movement of documents in and along a prescribed path has heretofore proved to be a very difficult transport problem.

The principal object of the instant invention is to provide a novel document handling means which will reliably assure the smoothing out and high speed travel of a series of documents in and along a fixed predetermined path through a document work station.

Another object of the invention is to provide a novel document handling device whereby a document that is being transported through a work station is physically smoothed out by being biased against a fixed guide surface which is positioned in predetermined relation with respect to a document operating means located at the work station.

Another object of the invention is to provide a novel arrangement for handling a series of documents whereby each moving document is successively biased against a smooth surface, said surface being effectively defined by the outer surface of a stationary guide member and the outer surfaces of at least one moving transport member.

Still another object of the invention is to provide a novel document handling apparatus whereby each of a series of moving documents is successively pneumatically biased against both a fixed guide surface and a moving surface of a document transport member; the biasing action toward said moving transport member being initiated and terminated respectively before and after the initiation and termination of the document biasing action toward said fixed guide surface.

Still another object of the invention is to provide an improved document handling device whereby each of a series of moving documents is successively pneumatically drawn up against a guide surface that is defined at least in part by a stationary surface and a moving document driving surface; the biasing action against said moving surface being sufficient to cause a longitudinal driving or feeding force to be applied to each document which force is effectively greater than the longitudinal feed retarding force caused by the biasing of each document against said stationary surface.

A further object of the invention is to provide a novel document handling means whereby a plurality of documents are successively fed through a work station and are biased against both a guide member having a stationary smooth planar guide surface and a substantially coplanar moving outer surface of a document feed belt; the biasing action being afforded by a sub-atmospheric pressure that is applied to the said guide surface and also to the cooperating outer surface of said belt.

Other objects of the invention will become apparent as the disclosure progresses.

In the drawings:

FIG. 1 is a perspective view of the apparatus embodying one form of the instant invention;

FIG. 2 is a front elevational view of the instant document guide head and related parts;

FIG. 3 is a vertical sectional view taken along section line 3—3 of FIG. 2;

FIG. 4 is a perspective view illustrating the construction for an exemplary portion of the document feed belt and pulley arrangement.

Referring to FIG. 1 the three main units of the instant apparatus which define a work or document read station 10 include a stationary guide head 11, a belt and pulley arrangement 12 for transporting successive documents such as 13 over the guide head 11 and a character sensing means 14 for reading the documents that move over the guide head 11. The head 11 is provided with suitable pneumatic means so that each document that is fed through the reading station is physically drawn up against the forward flat face of the guide head whereby each document is smoothed out so as to be substantially free of wrinkles and/or curls as it passes in front of reading head 14.

The document guide head 11 comprises a body 15, FIGS. 1–3, having a rearwardly opening chamber 16 formed therein that is closed by means of a rear plate 17. The forward face of the guide head 11 is provied with a smooth substantially flat polished planar guide surface 20 that is rounded off at either end by curved surfaces 21 and 22 so as to facilitate the sliding movement of each successive document onto and off of the flat guide surface 20. Fixedly secured to the lower forward edge of the guide head is a fixed shelf or track 23 which vertically supports the documents that are fed endwise through the work station 10.

The forward wall 24 of the guide body 15 is formed with a pair of vertically spaced and substantially parallel belt receiving grooves 25 and 26 on the bottoms of which are fixedly secured key-like members 27 and 30 respectively, said members being substantially parallel to and extending centrally along the lengths of said slots 25 and 26. The longitudinal ends of said key-like members are rounded off to facilitate engagement with the document feeding belts as will be later described. The forward wall 24 of the guide body 15 is also formed with a first set of vertically spaced and horizontally elongated holes or ports 31, 32, 33, 34, 35 and 36 which extend between the front guide surface 15 and the closed chamber 16. Another similarly arranged pair of ports or holes 37 and 40, FIG. 3, extend between chamber 16 and the bottom of said belt receiving grooves 25 and 26 so as to respectively register with correspondingly shaped ports or holes 41 and 42 formed through the key-like members 27 and 30. The closed chamber 16 is pneumatically connected to a sub-atmospheric pressure source by means of a suitable fitting 43 and hose 44.

The belt and pulley arrangement 12 for feeding documents comprises a pair of similar document transporting belts 50 and 51 which extend through slots 25 and 26 respectively and which run on a suitable pulley system 52 diagrammatically illustrated in FIG. 1. The outer surfaces 53 and 54 of the belts when passing through said

slots are substantially coplanar or coextensive with respect to the adjacent flat surface 20 of the guide head 11 as may be seen in FIG. 3. As is best illustrated in FIG. 4 each of the belts comprises a standard type toothed timing belt which cooperates in the usual manner with its associated toothed pulleys, such as 55, but which is structurally modified as follows. First a central longitudinal groove 56 is formed along the entire length of the inner side of the belt, and secondly the belt wall is formed with a plurality of longitudinally spaced holes 57 which extend between the bottom of the belt groove 56 and the outer surface, such as 53, of the belt. As is best shown in FIG. 3 the arrangement of the parts is such that when the belts are in position in the guide head grooves 25 and 26 the key-like members 27, 30 will ride in the respective inner belt grooves so that the ports 41, 42 in said members 27, 30 register with the line of holes, such as 57, in the belts 50, 51 respectively. The drive means for the belt pulleys are operated at a substantially constant speed. As will be apparent when the belts move through said guide head grooves 25, 26 and the holes in the belts successively experience a period of registry with ports 41, 42 a pneumatic connection is thereby established between the sub-atmospheric pressure source and the outside surfaces of those portions of the belts passing through said guide head slots 25, 26. The key-like members 27 and 30 riding in the respective belt grooves tend to improve the pneumatic seal between the inside of the belts and the guide head grooves 25, 26.

In the operation of the instant apparatus the sub-atmospheric source is connected to the guide head 11 and the drive means for belt and pulley arrangement 12 is operated so that a plurality of documents are separated and successively fed along the track 23 by means of the feed belt arrangement 12 acting in conjunction with other apparatus not shown. As each document such as 13, FIG. 1, is thus transported endwise into and through the reading station it will slide onto and over the smooth frontal surface 20 of the guide head 11 so as to thereby pass in front of the document reading head 14. In order for the reading means 14 to accurately sense recorded data on the document it is necessary to have the document flattened out and substantially free from severe wrinkles, curls, folds, etc. and also to have the document move along a uniform desired fixed path that is spaced in a predetermined manner from the operative parts of the read head 14. To this end the guide head surface 20 is shaped and located so as to define the desired document path through the read station, the shape of surface 20 in the instant exemplary case being preferably defined by a plane. The moving document 13 is pneumatically biased against said surface 20 so as to be flattened out to a substantially smooth condition as it moves along said path, this pneumatic biasing of the document being afforded by the sub-atmospheric pressure that exists at the outlet ports 31–36 in the fixed guide surface and also at those holes in the moving belts that are in registry with the ports 41, 42. The longitudinal frictional force exerted on the document by the moving belts is much greater than the frictional drag exerted on the document by the stationary guide surface 20, thus the document moves at the substantially uniform rate of speed of the belts as it passes through the work station. It will be noted that the slots or ports 41 and 42 are longitudinally longer than slots 30–36. This feature permits the belts to get a frictional grip on each successive document before the latter experience the frictional drag exerted by the guide surface 20 and in this way any tendency for the documents to become arrested at the work station is avoided even though each document is biased against the guide surface 20.

The above described apparatus has been tested using three inch by four inch size documents that are serially fed through the read station at rates up to 1500 pieces per minute and higher. The performance of the instant document handling means has proven to be very uniform and reliable thereby presenting the reading head 14 with the opportunity to efficiently scan the data recorded on those documents that are so transported through the work station 10.

Since many changes could be made in the embodiments of the invention particularly described and shown herein without departing from the scope of the invention, it is intended that these embodiments be considered as exemplary and that the invention not be limited except as warranted by the following claims.

What is claimed is:

1. Document handling apparatus; comprising
a guide head provided with a smooth guide surface that is formed with at least one elongated belt receiving groove,
a longitudinal movable feed belt extending through said groove,
said belt having a plurality of longitudinally spaced apertures formed therein and having an outer surface which when moving through said groove is substantially coextensive with respect to the adjacent portions of said guide surface,
said guide head having a plurality of holes formed therein, one of said holes terminating in the bottom of said groove in registry with the longitudinal line of holes formed in said belt, and the other of said holes terminating in that portion of the guide surface that is adjacent to said belt groove,
and means for pneumatically coupling said holes to a sub-atmospheric pressure source.

2. Apparatus as defined by claim 1 wherein said holes are relatively arranged so that a document being fed encounters a pneumatically operative hole in said belt before it encounters a pneumatically operative hole in said guide surface.

3. Apparatus as defined by claim 1 wherein said hole terminating in the bottom of said groove is wider than the holes terminating in the said adjacent portion of said guide surfaces.

4. Apparatus as defined by claim 1 wherein a portion of the bottom of said groove is defined by an elongated key-like projection which extends along the length of said groove and which is operatively received in a correspondingly cross sectionally shaped longitudinal groove formed on the inner side of said belt.

5. Apparatus as defined by claim 4 wherein the dimensions of the hole terminations in the outer surfaces of said key-like members, measured in a document feed direction, are greater than the corresponding dimensions of the holes terminating in said guide surface.

6. Document handling apparatus; comprising
a stationary guide head,
said guide head being provided with a smooth flat frontal guide surface that is formed with a pair of substantially parallel belt receiving grooves,
the bottom of each of said belt receiving grooves having an elongated key-like member extending therethrough,
a horizontally elongated hole formed through each of said members,
a belt extending through each of said grooves, the outer surfaces of the portion of said belts in said grooves being substantially coextensive with said flat guide surface,
each of said belts being formed along its inner surface with a central longitudinal groove which receives an associated one of said key-like members,
each of said belts also being formed with a plurality of longitudinally spaced holes each of which extend through the belt between the outer surface of the belt and the bottom of said belt groove,
said guide head being formed with a plurality of vertically spaced holes, some of said holes terminating in said guide surface laterally adjacent said belt receiv-

ing grooves, and others of said holes terminating in registry with the correspondingly shaped holes in said key-like members, the latter holes being in registry with the lines of holes formed in the respectively associated belts, and

means for pneumatically coupling said holes to a sub-atmospheric pressure supply.

7. Document handling apparatus; comprising

a stationary document guide means;

a movable document transport means for feeding a series of documents past said guide means;

the operative surfaces of said transport means and said guide means being mutually arranged in substantially coextensive relation and being disposed on one side of and defining a portion of a document guide and feed path; and

means coupled to said transport and guide means for biasing a document toward said path for smoothing out said document against the said coextensive operative surfaces of both said guide means and said transport means during the feeding movement of said document into and along said path;

said guide means including a smooth apertured wall and said transport means comprising an apertured movable feed member, the apertures formed in said wall and member being pneumatically connected to a sub-atmospheric pressure source.

8. Apparatus as defined by claim 7 wherein the outer surface of said wall and the outer surface of the cooperating portion of said member are substantially coextensive.

9. Apparatus as defined by claim 8 wherein the apertures formed in said member and wall are relatively arranged such that a document being fed encounters a pneumatically operative member aperture before it encounters a pneumatically operative wall aperture.

10. Apparatus as defined by claim 7 wherein said member apertures are coupled to said sub-atmospheric pressure source through one of said apertures in said wall.

11. Document handling apparatus; comprising

a stationary document guide means, said guide means having a recess formed therein;

a movable document transport belt for feeding a series of documents past said guide means, a portion of said belt extending through said recess;

the outer operative surfaces of that portion of said transport belt that is in said recess being substantially coplanar with the adjacent operative surfaces of said guide means, both of said operative surfaces being disposed on one and the same side of and defining a portion of a document feed path; and

means coupled to said transport belt and guide means for biasing a document toward said feed path for smoothing out said document against the said coplanar operative surfaces of both said guide means and said transport belt during the feeding movement of said document into and along said portion of said feed path.

12. Apparatus as defined by claim 11 wherein the last mentioned means comprises pneumatic conduits connected to a sub-atmospheric pressure source.

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